TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during April, 1923*—Continued.

RELATIVE HUMIDITY (%).

Altitude, m. s. l. (meters).	Broken Arrow, Okla. (233 meters.)		Drexel, Nebr. (396 meters.)		Due West, S. C. (217 meters.)		Ellendale, N. Dak. (444 meters.)		Groesbeck, Tex. (141 meters.)		Royal Center, Ind. (225 meters.)	
	Mean.	Departure from 5-year mean.	Mean.	Departure from 8-year mean.	Mean.	Departure from 3-year mean.	Mean.	Departure from 6-year mean.	Mean.	Departure from 5-year mean.	Mean.	Departure from 5-year mean.
Surface	65	0	65	−1	60	0	71	+4	71	+1	58	−5
250	65	0	.....	.....	60	0	.....	.....	71	+2	58	−5
500	63	−1	65	−1	61	0	69	+3	70	+3	59	−3
750	62	−1	65	0	61	−1	63	−1	70	+5	58	−3
1,000	60	0	62	−1	60	−2	58	−4	67	+7	57	−3
1,250	58	0	60	−2	59	−2	55	−5	64	+9	55	−4
1,500	58	+2	60	0	55	−4	52	−6	58	+8	55	−2
2,000	54	+3	58	0	53	−2	52	−4	55	+10	56	+3
2,500	52	+3	60	+2	48	−1	49	−5	58	+14	59	+8
3,000	53	+3	62	+3	46	+3	50	−4	56	+15	60	+10
3,500	59	+3	62	+3	42	+4	45	−9	53	+10	56	+5
4,000	49	−3	57	−3	41	+3	45	−9	61	+13	.....	.....
4,500	.....	.....	.....	.....	.....	.....	54	−2	59	+12	.....	.....
5,000	.....	.....	.....	.....	.....	.....	.....	.....	73	+12	.....	.....

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressur e during April, 1923*—Continued.

VAPOR PRESSURE (mb.).

Altitude, m. s. l. (meters).	Broken Arrow, Okla. (233 meters.)		Drexel, Nebr. (396 meters.)		Due West, S. C. (217 meters.)		Ellendale, N. Dak. (444 meters.)		Groesbeck, Tex. (141 meters.)		Royal Center, Ind. (225 meters.)	
	Mean.	Departure from 5-year mean.	Mean.	Departure from 8-year mean.	Mean.	Departure from 3-year mean.	Mean.	Departure from 6-year mean.	Mean.	Departure from 5-year mean.	Mean.	Departure from 5-year mean.
Surface	11.26	−0.40	7.42	+0.06	11.94	−0.73	6.14	+0.23	16.58	+1.32	6.91	−1.83
250	11.17	−0.39	.....	.....	11.74	−0.69	.....	.....	15.88	+1.39	6.81	−1.78
500	9.86	−0.40	7.05	+0.04	10.50	−0.41	5.93	+0.19	14.20	+1.50	5.75	−1.57
750	8.78	−0.39	6.38	+0.11	9.49	−0.41	4.98	−0.04	13.19	+1.83	5.17	−1.33
1,000	8.00	−0.24	5.97	+0.22	8.66	−0.45	4.21	−0.26	11.82	+1.95	4.69	−1.16
1,250	7.15	−0.24	5.48	+0.29	7.86	−0.39	3.74	−0.27	10.51	+1.96	4.22	−1.05
1,500	6.46	−0.13	5.23	+0.52	6.59	−0.65	3.32	−0.28	8.97	+1.70	3.92	−0.83
2,000	4.99	−0.12	4.31	+0.47	5.04	−0.35	2.72	−0.18	7.27	+1.71	3.27	−0.53
2,500	3.85	−0.25	3.57	+0.45	3.82	+0.01	2.11	−0.20	6.43	+1.91	2.80	−0.20
3,000	3.25	−0.21	2.96	+0.35	2.96	+0.21	1.71	−0.21	5.37	+1.85	2.38	+0.02
3,500	2.98	−0.17	2.40	+0.22	2.42	+0.32	1.29	−0.32	4.50	+1.63	1.92	−0.09
4,000	2.04	−0.33	1.78	+0.05	1.93	+0.18	1.15	−0.20	4.24	+1.86	.....	.....
4,500	.....	.....	.....	.....	.....	.....	1.16	+0.08	3.53	+1.73	.....	.....
5,000	.....	.....	.....	.....	.....	.....	.....	.....	3.53	+1.73	.....	.....

TABLE 2.—*Free-air resultant winds (m. p. s.) during April, 1923.*

Altitude, m. s. l. (meters).	Broken Arrow, Okla. (233 meters.)				Drexel, Nebr. (396 meters.)				Due West, S. C. (217 meters.)				Ellendale, N. Dak. (444 meters.)				Groesbeck, Tex. (141 meters.)				Royal Center, Ind. (225 meters.)			
	Mean.		5-year mean.		Mean.		8-year mean.		Mean.		3-year mean.		Mean.		6-year mean.		Mean.		5-year mean.		Mean.		5-year mean.	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel
Surface	S. 19° E.	1.6	S. 5° W.	2.9	S. 52° W.	1.3	S. 71° E.	0.4	S. 61° W.	1.7	S. 79° W.	1.6	N. 1° E.	1.2	N. 9° W.	1.6	S. 20° E.	2.3	S. 4° E.	2.5	S. 63° W.	2.4	S. 43° W.	2.6
250	S. 19° E.	1.6	S. 6° W.	3.0	.....	.....	.....	.....	S. 62° W.	1.9	S. 77° W.	1.8	.....	.....	.....	.....	S. 19° E.	2.9	S. 4° E.	3.2	S. 61° W.	2.5	S. 43° W.	2.7
500	S. 13° E.	2.7	S. 13° W.	4.4	S. 47° W.	1.8	S. 57° E.	0.5	S. 53° W.	3.1	S. 65° W.	3.1	N. 6° E.	1.1	N. 10° W.	1.4	S. 7° E.	4.0	S. 4° W.	4.8	S. 56° W.	4.5	S. 41° W.	4.6
750	S. 3° E.	3.2	S. 16° W.	5.5	S. 68° W.	2.6	S. 32° W.	0.1	S. 54° W.	4.0	S. 64° W.	4.1	N. 27° W.	0.8	N. 17° W.	0.8	S. 6° W.	4.3	S. 13° W.	5.5	S. 53° W.	5.1	S. 44° W.	6.0
1,000	S. 28° W.	2.8	S. 27° W.	6.1	S. 69° W.	4.0	S. 61° W.	0.7	S. 58° W.	5.4	S. 60° W.	5.2	N. 69° W.	2.4	N. 45° W.	1.0	S. 21° W.	4.9	S. 23° W.	6.3	S. 60° W.	5.9	S. 50° W.	6.4
1,250	S. 49° W.	3.6	S. 37° W.	6.3	S. 74° W.	4.6	S. 76° W.	1.5	S. 64° W.	7.3	S. 67° W.	7.4	N. 56° W.	3.6	N. 50° W.	1.8	S. 38° W.	5.5	S. 33° W.	6.9	S. 72° W.	6.2	S. 61° W.	6.9
1,500	S. 63° W.	3.9	S. 53° W.	7.0	S. 83° W.	6.3	S. 82° W.	2.5	S. 65° W.	9.4	S. 68° W.	8.3	N. 53° W.	4.0	N. 52° W.	2.2	S. 50° W.	6.0	S. 37° W.	7.5	N. 73° W.	4.6	S. 70° W.	7.3
2,000	S. 78° W.	5.3	S. 61° W.	8.0	N. 88° W.	7.4	W.	4.0	S. 76° W.	10.3	S. 79° W.	9.6	N. 58° W.	4.8	N. 67° W.	2.5	S. 58° W.	7.8	S. 48° W.	8.6	N. 64° W.	6.9	S. 80° W.	8.0
2,500	S. 84° W.	5.3	S. 70° W.	8.7	S. 84° W.	7.8	W.	5.8	S. 84° W.	10.2	S. 82° W.	10.4	N. 63° W.	6.3	N. 74° W.	3.7	S. 70° W.	8.3	S. 56° W.	9.5	N. 45° W.	9.0	S. 83° W.	8.3
3,000	N. 88° W.	6.2	S. 79° W.	8.4	W.	10.8	N. 83° W.	8.5	N. 83° W.	10.7	S. 86° W.	11.6	N. 76° W.	8.8	N. 76° W.	5.0	S. 70° W.	10.5	S. 61° W.	11.9	N. 32° W.	16.4	S. 84° W.	10.6
3,500	N. 85° W.	9.5	S. 86° W.	11.7	S. 80° W.	13.0	S. 85° W.	10.4	N. 69° W.	10.0	N. 84° W.	11.5	N. 83° W.	10.3	N. 79° W.	6.7	S. 81° W.	10.5	S. 69° W.	10.8	N. 22° W.	22.8	S. 76° W.	11.8
4,000	W.	13.8	S. 80° W.	14.4	N. 80° W.	15.2	N. 87° W.	12.8	N. 65° W.	12.2	N. 72° W.	13.9	N. 39° W.	6.3	N. 64° W.	7.8	S. 70° W.	9.4	S. 83° W.	13.3	.....	.....	.....	.....
4,500	S. 67° W.	24.5	S. 76° W.	18.6	N. 45° W.	20.7	N. 75° W.	13.3	N. 37° W.	9.5	N. 42° W.	13.7	N.	22.0	N. 55° W.	8.5	S. 66° W.	12.0	S. 73° W.	14.4	.....	.....	.....	.....
5,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	N.	26.7	N. 56° W.	15.9	N. 89° W.	13.8	N. 89° W.	13.8	.....	.....	.....	.....

THE WEATHER ELEMENTS.

By P. C. DAY, Meteorologist, in Charge of Division.

PRESSURE AND WINDS.

The outstanding feature of the weather for April, 1923, was the marked anticyclone that had advanced into the central valleys by the end of March and to the more eastern districts by April 1 and off the Atlantic coast during the following 24 hours. This anticyclone was of unusual strength for a mid-spring month and dominated the weather over practically all districts between the Rocky Mountains and the Atlantic coast during its movement eastward. Clear skies and favorable conditions for radiation prevailed, and over much of the area mentioned the accompanying night temperatures were the lowest ever observed so late in spring.

Aside from the above the anticyclones of the month were usually unimportant, although a moderate area of high pressure with sharp changes in temperature moved from the upper Missouri Valley into the Great Plains on the 7th and 8th, and thence to the more eastern districts within the following 48 hours. Later in the month anticyclonic conditions prevailed over the more northern districts, particularly about the 23d and for several succeeding days, when a high-pressure area of wide extent, but lacking the strength of that at the beginning of the month and without the marked effect on temperatures usually expected, moved from the near Northwest into the Lake region and thence eastward, reaching the Atlantic coast districts about the 26th.

The cyclones of the month were mainly active only over short paths, and these were largely confined to the central and eastern districts, the storms usually losing strength as they approached the Atlantic coast.

An exception to this, however, is noted in the case of a cyclone that developed in the far Northwest on the 6th and moved to the middle Plains by the morning of the 7th and to the Great Lakes, St. Lawrence Valley, and Canadian Maritime Provinces within the following 48 hours. The precipitation attending this cyclone was mainly light and lacked the even distribution usually expected, large areas near the center of the disturbance at times receiving little or no precipitation.

A cyclone of only moderate proportions, but which gave abundant precipitation over wide areas in the Southern and Eastern States, but losing force as it approached the coast, moved slowly from Texas on the morning of the 12th to the more eastern districts during the following few days. This cyclone brought heavy

precipitation over much of Texas and the lower Mississippi Valley and locally in the Ohio Valley and near-by portions of other districts.

Cyclonic condition prevailed over the Great Plains and central valleys near the beginning of the third decade and continued for several days. This was shortly followed by another period of unsettled weather which gradually drifted eastward, giving local rains over many central, southern, and eastern districts, the falls being moderate to heavy in portions of the middle Plains and along the Atlantic coast.

The average pressure for the month was highest over the Southeastern States and along the immediate Pacific coast, conditions usually prevailing at the mid-spring period. It was low, as usual, in the far Southwest and over New England and the Canadian Maritime Provinces. On the whole the monthly averages were close to normal in practically all districts.

Compared with the averages for March, those for April were lower in all districts, and this, too, is usually the case, save along the North Pacific coast, in northern New England and over the eastern Canadian districts, where the April pressures are normally higher than those for March.

The distribution of the average pressure for the month was comparatively even, the gradients between the regions of highest and lowest pressure being small. As a result the prevailing winds were from common directions over only small areas as a rule, although in the Great Plains they were mainly from the south, as is usual at this period.

High winds over large areas due to cyclonic action were comparatively infrequent, but local high winds were quite frequent, and tornadoes of more or less severity occurred in several localities, some being attended by material loss of life and damage to property.

A list of the storms of the month, as far as reports are available, with some of the important details appears at the end of this section, and complete accounts of some appear in another portion of this issue.

TEMPERATURE.

Easter Sunday, April 1, 1923, set a new mark for low temperatures over practically all districts from the Ohio Valley and lower Lakes eastward to the Atlantic coast. In this area the minimum temperatures were lower than ever before recorded in April, and in some cases they were 10° or more lower than any previous record for so late in spring.

Aside from this severe cold period, and one materially less severe toward the end of the first decade over most districts from the Rocky Mountains eastward, there were no important temperature changes during the remainder of the month over the principal agricultural areas. On the whole, however, the first half of the month was decidedly cold over nearly all central and eastern districts and moderately warm in the far West. On the other hand, the latter half of the month was mainly slightly warmer than normal over central and eastern districts, while cool weather for the season prevailed to the wesward.

For the month as a whole the temperature was below normal over the greater part of the country, but the deficiencies were mainly small. Over a small area along the Atlantic coast from eastern Virginia to southern New England the averages for the month were slightly higher than normal, and similar conditions prevailed near the Gulf coast, over the central and southern Great Plains, and along the immediate Pacific coast.

The warmest periods of the month were about the 15th to 19th, from the Great Plains westward; and about the 21st to 23d, from the Mississippi Valley eastward.

At Walla Walla, Wash., and Portland, Me., the maximum temperatures on the 15th and 21st, respectively, were the highest ever observed at those points in April.

The lowest temperatures of the month were observed on the 1st over all districts from the Mississippi River eastward, and over a few States to the westward. In the Great Plains and to the westward the coldest days were mainly in the first decade. The lowest observed, −34°, occurred in northern Michigan, and a reading of −24° was reported from northern New York. Freezing temperatures or lower were reported from every State except Florida, where 34° was the lowest observed.

The continued cold over the Great Lakes resulted in an unusual accumulation of ice in the more northern portions, and the opening of navigation at the Soo was much delayed.

PRECIPITATION.

The precipitation of April, as a whole, was sufficient over most of the country, and was comparatively large in the central Plains and in almost all districts to southward and southeastward. Unusually heavy rainfall occurred in southeastern Texas, central Louisiana, and central and northern Mississippi, Brookhaven, in the last-named State, measuring more than 16 inches. Substantially all of Texas, save the vicinity of the Rio Grande, and nearly all districts to southward of the lower Missouri and of the Ohio and Potomac Rivers had more than normal rainfall, except from central Florida northward and northeastward to the vicinity of Hatteras there was a marked shortage. However, the southern portion of Florida and some areas near the central east coast received marked relief from the dry conditions that had so long prevailed. Near Chesapeake and Delaware Bays the amounts were well above normal, likewise in most of New England, particularly in central Maine, where heavy rains near the end of the month, with the rapid melting of the remainder of the winter's snowfall, caused serious floods. In northern Michigan also there were considerable floods late in the month, the rapid melting of deep snows, when a marked rise of temperature set in, being the main factor. To northward of the Potomac and Ohio Rivers the month's precipitation usually fell short of the normal by slight to moderate amounts; but from southeastern Iowa eastward to northwestern Ohio and southern Michigan there was a notable shortage, and rain was considerably needed there when the month closed.

In the western half of the country the distribution was more uneven than usual, and the month's totals were less than normal in western South Dakota, central and southern Colorado, western New Mexico, and southern Arizona; also in northern and western Montana, nearly all of Washington, and much of Oregon and Idaho. In California, on the other hand, the month was considerably the wettest April of the 27 for which State-wide averages have been computed, the excess being most notable in the central portion, and being of vast benefit in overcoming the results of the shortages in February and March. The excess of precipitation was felt to eastward, in nearly all parts of Nevada and Utah and the upper Snake River drainage basin.

SNOWFALL.

The snowfall of April occurred chiefly in the early portion of the month. It was about average in amount in the northeastern portion, including the region of the

lower Lakes, but it was considerably more than average in Wisconsin and upper Michigan, where most of it came during two storms of the first week. In Ohio and Indiana and in Kansas and western Missouri the southern limit of the snowfall was unusually far to the north for April.

In the elevated portions of the Western States conditions varied greatly; but the snowfall was light in most mountain portions of Arizona and New Mexico and of many of the more northern States. On the other hand, the California, Nevada, and Utah mountain areas had much more than the normal amounts for April, especially the Sierra regions between 40° and 36° latitude. Here Glacier Point, Calif., recorded no less than 113 inches fall during the month.

The snow remaining at high levels at the end of April did not give promise of abundant stream flows next summer in Arizona and in most parts of the North Pacific States. In California and Nevada the April falls considerably improved the prospects, yet they were mainly a little below average; the April snowfall did not pack well, and the late summer water supply is likely to be inadequate. In Utah, Idaho, and the Rocky Mountain States the prospects for stream flow were usually rather better than the average.

RELATIVE HUMIDITY.

The distribution of the relative humidity, like the precipitation, varied greatly at near-by points, but on the whole the monthly averages were below normal from the middle Mississippi Valley eastward and northeastward to the Atlantic coast. Over other districts the averages were mainly above normal, with the greatest excesses in the southern portions of the Great Plains and Plateau regions, and locally in central California.

SEVERE LOCAL STORMS, APRIL, 1923.

The table herewith contains such data as have been received concerning severe local storms that occured during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau.]

Place.	Date.	Time.	Width of path (yards).	Loss of life.	Value of property destroyed.	Character of storm.	Remarks.	Authority.
Chappells, S. C.	4					Wind	School building wrecked	Official, U. S. Weather Bureau.
Wake-Nash county line, N. C.	4	6 p. m.			$100,000	Tornado	25 small buildings damaged or completely destroyed, also about 40 tobacco barns and outhouses; many large trees uprooted; 2 persons injured.	Do.
Cass County, Tex. (northeast part of).	4	P. m.	100		35,000	do	About 20 buildings wrecked	Do.
Alexandria and Pineville, La.	4	6 p. m.		14	500,000	do	About 142 buildings damaged, and 60 persons injured; path 3 miles long and several hundred yards wide.	Times-Picayune (New Orleans, La.); Post (New York).
El Dorado, Ark., and vicinity.	4	5 p. m.				Wind and hail	Several farmhouses blown from foundations, 1 demolished; 1 man injured.	Southwestern American (Fort Smith, Ark.).
Yazoo City, Miss.	4	P. m.		2		Wind	No property damage reported	Times-Picayune (New Orleans, La.).
District of Columbia and adjacent Maryland.	5	3 p. m.	200		100,000	Tornado	4 persons hurt; 7 houses in Silver Springs and Avenel demolished; many other houses and outbuildings damaged; hundreds of trees uprooted, broken, or torn; path 11 miles long.	Official, U. S. Weather Bureau.
Philadelphia, Pa., and adjacent districts.	5					Wind and rain	A score of houses partly wrecked in city; other serious damage in nearby counties.	Do.
Hunterdon County, N. J.	5					do	Thousands of dollars property damage	Do.
New Castle County, Del.	5					Thunderstorm	Farmhouses, barns, telephone and telegraph poles damaged.	Do.
Magnolia Springs, Tex. (vicinity of).	6	8 p. m.			3,000	Wind	Crops and buildings damaged	Do.
Rochester, N. Y., and nearby counties.	8	P. m.				Wind and rain	Heavy property damage; County Agricultural Society and farmers sustain heavy losses; big dining hall demolished.	Post Express (Rochester, N. Y.).
Meridian, La.	12	4:30 a. m.				Tornado	15 houses wrecked, 45 others damaged; 6 persons injured.	Item (New Orleans, La.); Shreveport Journal (La.).
Cullman, Ala.	12	P. m.				Wind	3 persons injured, several residences and barns blown down, and scores of animals killed; all wire services paralyzed.	Inquirer (Owensboro, Ky.).
Lafourche, La., and vicinity.	13	A. m.	200	2	100,000	Tornado	Many houses wrecked and 25 persons injured	Times-Picayune (New Orleans, La.).
Anniston, Ala.	13	9:30 a. m.				Wind	Several houses and barns unroofed; trees uprooted and wires damaged.	Anniston Star.
Greenville, S. C.	13	4 p. m.			1,000	Tornado	Small dwellings destroyed	Official, U. S. Weather Bureau.
Augusta, Ga.	13	P. m.				Wind and rain	Several stores damaged; trees, plate-glass windows, and wires suffer most from wind; car traffic held up.	Greenville News (S. C.).
Orange, Tex.	20	4 p. m.				Wind	Portion of roof of lumber shed blown off	Official, U. S. Weather Bureau.
Central Illinois	21	A. m.				do	Considerable damage done to trees, residences, poles, wires, and outhouses.	Do.
Chicago, Ill.	21			1		do	Some property damage	Do.
Ludington, Mich. (5 miles southeast of).	21	1 p. m.	200		1,000	do	High winds damage trees, buildings, etc.; path 5 to 10 miles long.	Do.
Randolph, Utah	22					do	Chimneys, haystacks, and some roofs damaged	Do.
Donaldson, Tenn.	23	Noon.				Thunderstorm	Schoolhouse damaged and about 30 children injured.	Do.
Barneston, Kans. (near).	23	P. m.		2		Tornado	1 home totally destroyed; path 4 miles long	Wichita Eagle (Kans.).
Burkburnett, Tex. (vicinity of).	24	8-9 p. m.			25,000	do	5 residences and 6 oil derricks destroyed	Official, U. S. Weather Bureau.
Henrietta, Tex. (vicinity of).	24	7:20-8:20 p. m.	1,760		200,000	Wind	Crops and buildings severely damaged; storm was accompanied by hail; path 15 miles long.	Do.
Syracuse, Kans. (2 miles southwest of).	27	2 p. m.		1		do	Teacher of school killed and 2 children injured	Wichita Eagle (Kans.).
Mobile County, Ala.	27				5,400	do	Considerable property damaged; storm was accompanied by hail.	Official, U. S. Weather Bureau.
Dardanelle and Russellville, Ark. (country surrounding).	28				200,000-300,000	Wind and rain	Houses unroofed and crops damaged; 1,500 acres of cotton will have to be replanted; heavy hail accompanied storm.	Do.
Waltersville, Miss.	28					Wind	Damage principally to residences, telephone and trolley lines, and to an industrial plant.	Do.
Little Island Coast Guard Station, Va.	29	12:01 a. m.				Tornado	Station, 3 residences, and several outbuildings demolished; 600 yards of telegraph line blown down.	Do.